STATE & PRIVATE FORESTRY
FOREST HEALTH PROTECTION
SOUTH SIERRA SHARED SERVICE AREA

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Subject: **Rock Creek Healthy Forest Restoration Project 2018**

Summary

This report summarizes South Sierra Shared Service Area, Forest Health Protection discussion and recommendations regarding the Rock Creek Healthy Forest Restoration Project 2018, Mi Wok Ranger District, Stanislaus National Forest. The Rock Creek Project was initiated under the 2014 Farm Bill, which amends the Healthy Forest Restoration Act by adding two new sections 602 and 603 to HFRA's Title VI. Section 603 provides a new categorical exclusion to expand proposed (treated) units up to 3000 acres. The proposed project boundary falls within landscape scale areas (watersheds) that are considered under threat by insects and diseases as designated by USDA Forest Service Chief and Region 5 (letter signed November 24, 2015). This project meets criteria to utilize the Farm Bill initiative:

1. *Proposed project areas in which the risk of hazard trees poses an imminent risk to public safety, health, and infrastructure*
2. *Project is experiencing large scale insect and disease mortality as detected by annual FHM Aerial Detection Surveys*
3. *Proposed project areas are at high risk over the next 15 years for heightened insect and disease activity determined by 2012 National Insect and Disease Risk Map (NIDRM)*[1]

The Rock Creek project sits along the Clavey River watershed, between Dodge Ridge and Rock Creek. Elevation ranges between 4000-7000 feet. At the lower elevations, forest type is predominantly mixed conifer ponderosa pine or white fir type. Transition zones of white fir to red fir with smaller percentages of pine comprise the upper elevations. Stand density is estimated at the higher ends of indexes, as thinning or burns

[1] *National Insect and Disease Forest Risk Assessment 2013-2017 (2014)(National Insect and Disease Risk Map (NIDRM) is a nationwide strategic assessment and database of the potential hazard for tree mortality due to major forest and diseases. Risk in these models was the expectation that, without remediation, at least 25% of the standing live basal area great than one inch in diameter will die over a 15-year time frame due to insects and diseases.*

have not been implemented here for some time. Basal areas range from 170 to 290 ft2/acre. Stands of legacy-sized sugar and ponderosa pines, as well as red fir can be found scattered amongst the project area.

However the recent drought event in California (2011-2016) experienced high levels of bark beetle-associated mortality in sugar, ponderosa, and white fir of variable diameters across large landscapes, particularly in Stanislaus NF (FHM ADS, see Appendix A). Incense cedar mortality appears directly caused by drought rather than damage agents (ex: few trees found with signs of insects or pathogens). According to summaries of 2015-2017 aerial detection surveys (FHM ADS), over 90% of area within the project boundary was affected to some degree by bark beetles or drought effects over those three years alone (see Appendix B). Forty percent of the project area experienced severe mortality 2017 (>35% affected) in white and red fir zones. Field observations and stand exams determined that majority of the mortality was in moderate to large diameter white fir, as well as sugar pines.

Root diseases are often overlooked as a major contributor of mortality in the Sierra Nevada. Bark beetles are considered primary damage agents for some conifer species, but root diseases do cause underlying stress and weakening of trees that render them susceptible to other damage agents. Their ability to persist in roots, stumps, and underground connections with living trees allows for long-term persistence in stands, eventually affecting residual hosts and upcoming regeneration. True firs are especially susceptible to root diseases in the western Sierras, particularly in the southern range where forest conditions are more conducive to root disease prevalence (ex: higher percentages of host type). A complex of insects (Struble 1957) closely follow stress levels in firs, attacking local sections or entire trees if conditions are suitable. Drought events often trigger increases in whole tree mortality, which has been consistently recorded in California following periods of below normal precipitation (Oblinger et al. 2012). While many of these diseases are native, management of identified infected areas is essential to restoration and long-term resilience in the forest.

Root Rots

The best summary of diseases in the Sierra Nevada is found in Paine and Lieutier's (eds) book, Insects and Diseases of Mediterranean Forest Systems. In that book (Cannon *et al*, 2016) describe the *heavy hitter diseases*, and of that group only *Heterobasidion* root disease is likely to impact the Rock Creek Healthy Forest Restoration C.E. Project, and even then, in the short term, only one species is likely to be a major problem. *Heterobasidion occidentale* (aka the fir or "S" type) the disease of true firs. This disease has an (Graham 1971; Smith 1970) effective and cost efficient means of disease mitigation and prevention. Kleijunas (1989) summarized the existing literature on borax effectiveness in the eastside pine type.

Mitigation methods are described in the R05 *Heterobasidion* root disease web page at; http://www.fs.usda.gov/detail/r5/forest-grasslandhealth/insects-diseases/?cid=stelprdb5329386. The actual Regional Policy is described in the FSH FSH 3409.11 at:
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5329399.pdf
This Regional web page provides links to commonly asked questions about the treatment. FHP is available answers to other questions, and provide training in the application of these preventative measures.

The second *Heterobasidion* species, *H. irregulare* (aka the pine or "P" type) is not common on the Forest. However if it becomes established in a stand, it will be there permanently or at least until there is a species conversion away from pines. For this reason it is important to ensure that future activities do not increase root disease establishment in pines. Current incidence in pine is low and if prevention measures are implemented, infection by *Heterobasidion* root disease remains that way. Forest restoration goals are to create sustainable conditions such that mortality (of any species) remain at background levels, and natural process occur within historical ranges.

While both of these diseases are native and have coevolved with their hosts, neither was a significant cause of mortality until after the Gold Rush of 1849. As the prospectors, settlers, farmers, and ranchers cut trees for needed timber, the stumps and wounds left behind provided avenues for the fungus to gain a greater access to its hosts, especially if the stump was grafted to an adjacent living tree. Today the level of *Heterobasidion* root disease in the Central Sierras is elevated above where it was prior to the Gold Rush (Cannon et al. 2016). Over the last decade, repeated observations on both Stanislaus and Eldorado National Forests have examples of the long term effects of beetle-killed salvage in which no protection was applied to cut stumps of white fir; thereby, evidence of *Heterobasidion* is often found.

Working in Finland Kallio (1970) has produced the most detailed assessment of the airborne spread of *Heterobasidion* spores and his paper reports spore spread over distances of 44 to 310 miles. Working in England, Rishbeth (1959) found spores of *Heterobasidion* had been carried over 200 miles of sea. Looking for an American estimate, UC Berkeley professor Matteo Garbelloto obtained an estimate of 1600 ft (500 m). Knowing that the majority of spores are deposited close to the initiating conk, Kallio (1970) found that at 200m from a conk, the 5 minute exposure of a petri dish was adequate to capture this fungus. That petri dish equates to a 4 inch stump exposed for 5 minutes. A 200m radius cuts out an area of about 31 acres. Meaning that if there is a conk within the 31 acres surrounding the cut stump, it has a creditable risk of being infected. Surveying found conk density is well above 1 conk per 31 acres, therefore the project area is within the reach of *Heterobasidion* root disease.

Prescription recommendation. Recommend application of an approved borate dressing to *all* freshly cut stumps above 10 inches, especially recommended for all freshly cut stumps in forest health units managing stem density. This application should follow the R05 guidelines listed above.

White Pine Blister Rust (WPBR)

Cronartium ribicola (WPBR) is an exotic disease and has become the most damaging and threatening disease (Wood *et al*, 2003) to all of California's five needle pines. To date, WPBR has been the most expensive disease to attempt control nationally. There is no proven means of control for WBPR. However, breeding for resistance offers some hope (Kinloch and Dulitz, 1990). Breeding programs have shown that there are mother trees bearing Major Genes for resistance (MGR).

Within the project are there are several MGR sugar pine trees, and have been the subject of at least two earlier projects. In 1993 the Rust Resistant Sugar Pine project (M0993-18) the MGR trees were radially thinned and metal-banded around the bole to prevent squirrels climbing the trees, thereby gaining access to

cones. At this time, stumps around MGR trees are treated with Sporax™ to prevent the spread of *Heterobasidion* root disease. In a second project on the Mi-Wok Ranger District, the Rust Resistant Sugar Pine stress relief project of 2004 (M06027), ½ acre under each MGR tree was disturbed by brush clearing and tree felling activities. The total area cleared was 24 acres. These trees will become a source of future seed upon which the restoration activities of this project will be replicated. WPBR is most damaging to sugar pine seedlings and saplings killing many of them quickly, while it only kills legacy-sized trees slowly. During the recent drought, large diameter sugar pines were at a higher risk of dying from mountain pine beetle (*Dendroctonus ponderosae*). The fact that so few MGR tree appeared to have died during this last drought may be testimony to the success of the earlier stress reduction project. However, the biggest threat to future forest health from WPBR is the loss of pole and seedling classes. Eventually natural regeneration will have to be augmented by planting sugar pines derived from MGR seed bank if the trend continues.

***Prescription recommendation for MGR trees*.** It is recommended that banded-proven MGR tress never be cut and believe that the application of the stand level silvicultural guidelines will ensure the survival of the MGR trees. The stand silvicultural guidelines will eliminate ladder fuels under the MGR trees. Previous projects have left them in a condition that they will require a minimal radial thinning of 20 ft spacing is left between the crown of the MGR and its nearest neighbors. Treatments will provide better protection until the next entry or controlled burn. Twenty foot spacing was selected because squirrels struggle to jump that far between trees.

Post project monitoring should go back to ensure that treatments did not damage squirrel bands and at the same time select for genetic screening new candidate trees from those seed zones that are under-represented in the seed bank. With fuel reduction around selected trees, reintroduction of fire in a year in which we have a good cone crop in MRG trees and thus maximize the regeneration of MGR trees.

<u>Bark Beetles</u>

General Technical Report-237 (North 2012) based on the GTR-220 (North et al. 2009) provide suitable guidelines and considerations of mixed-conifer forest management in the Sierra Nevada that is also applicable for bark beetle prevention. Topography, elevations, and aspect are good parameters in which to gauge adequate density for most sites; improving overall tree vigor improves tree resistance. White fir on drier south facing slopes, or lower elevations where moisture is very limited are often the first to succumb during times of drought due to insect infestation. Pines require lower basal area conditions than currently found in most western forests to reduce risk of bark beetle attack (Fettig et al. 2007, Oliver 1995) as well as resilience against future climate changes that lead to more intensive wildfires (van Mantgem et al 2013). This is evidenced in the recent outbreak by Young et al (2017) who determined that stands with moderate to higher basal areas experienced substantial mortality even when water deficit was not very intense. Suggested guidelines to treat proposed units such that return maintenance can be prolonged for at least twenty years may be adequate at keeping bark beetle associated mortality near background levels for a longer term regardless of variation in annual precipitation.

The recent bark beetle outbreak may have already significantly reduced overstocking in some areas of the project, but the resulting structure in severely affected stands may need restoration to achieve future desired conditions. An immediate concern is the potential wildfire behavior (particularly severity and intensity) that could result due to all the standing dead trees that eventually become downed long-lasting fuel beds. Mitigation of immediate hazards along roads, structures, campgrounds, etc. is essential for public safety but the loss of tree cover also affect other objectives. The stark loss of pines – sugar and ponderosa – in some areas will shift species composition to less diverse, or age classes that may be unable to thrive due to unfavorable conditions (ex: shade intolerance). Treatments may need to be innovative and progressive in order to achieve desired conditions, or at least take proactive steps towards restoration.

If there are further questions regarding this project or regarding this report, please do not hesitate to contact us.

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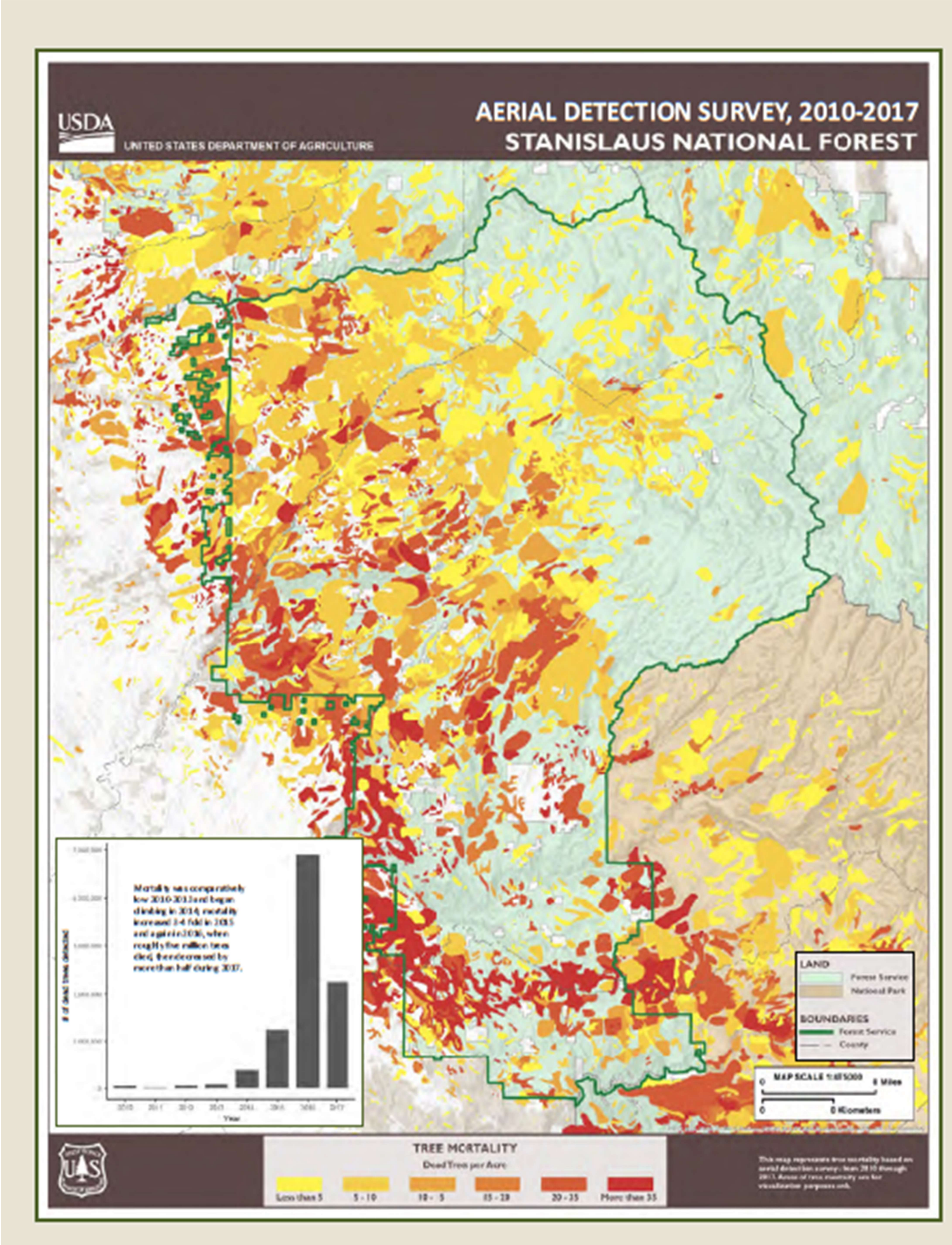
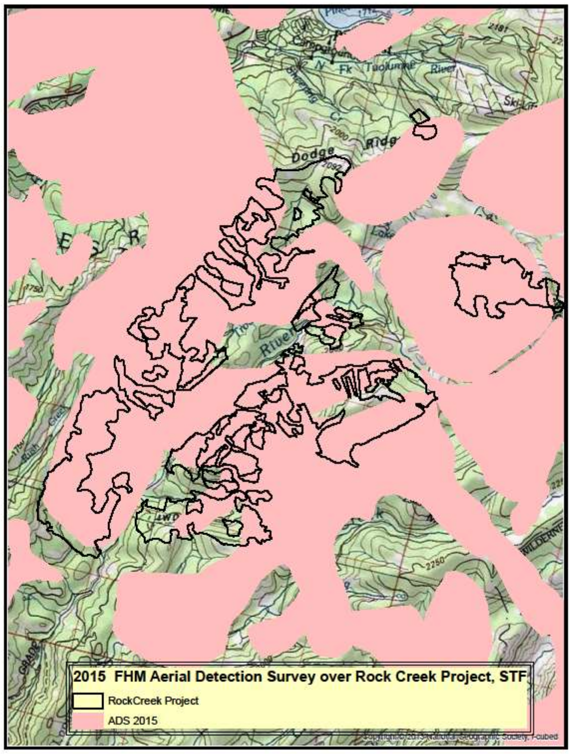
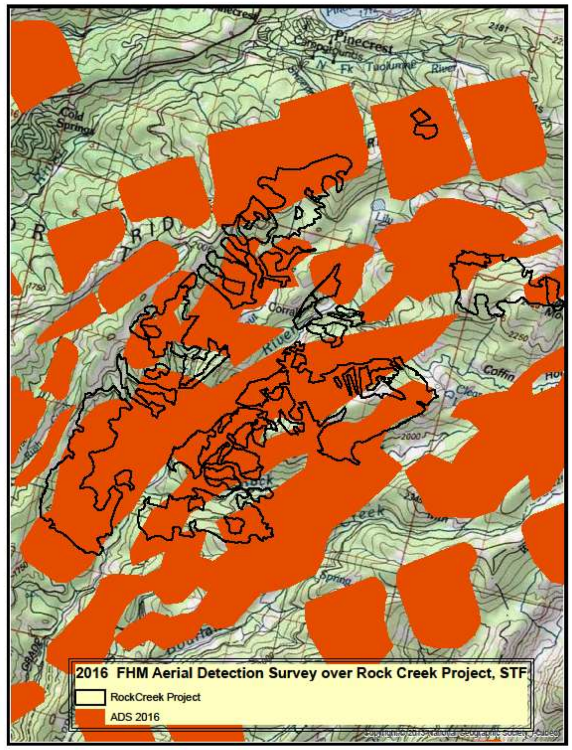
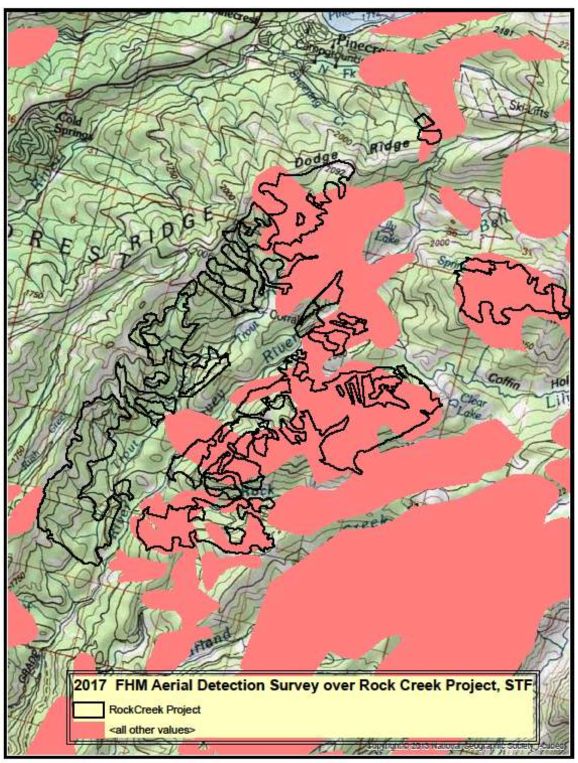
Appendix A. 2010-2017 FHM Aerial Detection Surveys of Stanislaus National Forest (*compiled*).









Appendix B. Map progression of detected tree mortality 2015-2017 (FHM Aerial Detection Surveys) within and around Rock Creek Project, STF